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Research on the Construction of Pharmaceutical Professional Quality Evaluation System under the Background of Industry-education Integration

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Abstract: ***In the context of the in-depth promotion of industry-education integration, the construction of a scientific and reasonable evaluation system for pharmaceutical professional quality is of great significance to pharmaceutical vocational education. Starting from the intrinsic relationship between industry-education integration and professional quality, this study systematically sorted out the limitations of the current evaluation system and revealed the driving role of industry-education integration in the reconstruction of evaluation dimensions. On this basis, according to industry needs and educational laws, a "multi-dimensional dynamic" construction principle was proposed, and a three-dimensional framework covering core indicators such as professional ethics, practical skills, and innovative collaboration was designed. Multiple evaluation subjects such as enterprise mentors and clinical experts were introduced to form a "process + result" two-dimensional evaluation mechanism. Through the collaborative development of evaluation tools between schools and enterprises and the co-construction of feedback and improvement mechanisms, the precise connection between pharmaceutical talent training and industry needs is promoted, providing scientific support for the cultivation of compound pharmaceutical talents with job competence and career development capabilities.***

Keywords: Integration of industry and education; Pharmacy professionalism; Evaluation system; Vocational education; Talent training.

1. INTRODUCTION

With the vigorous development of the pharmaceutical industry, the requirements for the professional quality of pharmaceutical professionals are increasing. As an important direction of vocational education reform, the integration of industry and education has brought new opportunities for the cultivation of pharmaceutical talents. In this context, building a scientific, comprehensive and practical evaluation system for pharmaceutical professional quality will not only help to accurately evaluate students' professional quality level, but also provide strong support for the reform of pharmaceutical vocational education and teaching, and promote the deep connection between talent training and industry needs. This study focuses on this and aims to contribute to improving the quality of pharmaceutical vocational education.

2. OVERVIEW OF INDUSTRY-EDUCATION INTEGRATION AND PHARMACY PROFESSIONALISM

2.1 Connotation and Development of Industry-education Integration

The essence of the education industry linkage mechanism is to build a two-way empowerment system with mutual access to school and enterprise resources and complementary advantages. This mechanism transforms market technology needs into teaching resources, promotes the closed loop of knowledge transfer and industrial application, and thus realizes the effective connection between education supply and industry needs. Looking back on the development process, there was an obvious disconnection in the vocational training system in the initial stage, and there was no effective dialogue channel between the curriculum design of colleges and universities and the needs of the real industry. With the surge in demand for compound talents due to industrial upgrading, the school-enterprise collaboration mechanism has gradually become a key path to solve the structural employment contradiction. At the current policy level, through the establishment of school-enterprise joint laboratories,

dual-teacher teaching teams and other carriers, a diversified practice paradigm of production and research collaboration has been formed. The promotion of order-based talent incubation projects and the alternating training model of work and study has not only shortened the job adaptation cycle of graduates, but also catalyzed the industrial application of technological innovation results. This dynamic adjustment and coordination mechanism is reconstructing the interactive relationship between the traditional education model and the industrial ecology.

2.2 The Connotation and Components of Pharmacy Professionalism

The pharmacy professional competency system is essentially a comprehensive competency framework for practitioners to solve complex pharmaceutical issues. The key lies in building a solid disciplinary foundation. It is necessary to master core technologies such as drug chemistry analysis, and to have clinical thinking such as prescription review and adverse reaction monitoring. Drug services are directly related to public health and safety, which determines that practitioners must strictly abide by the bottom line of drug safety and always maintain a prudent and responsible attitude in formulation development or medication guidance. Different from ordinary technical positions, pharmacists also need to have dynamic adaptability. In the face of the current situation of shortened new drug development cycles, continuous learning ability and effective communication skills are particularly important. For example, in clinical pharmacy practice, it is necessary to independently complete drug blood concentration monitoring and be good at collaborative treatment with the medical team. These dimensions support each other to form a closed loop and jointly shape the characteristics of compound pharmaceutical talents that meet the needs of modern medical care.

3. ANALYSIS OF THE CURRENT STATUS AND PROBLEMS OF PHARMACY PROFESSIONAL QUALITY EVALUATION

3.1 Overview of the Existing Evaluation System

At present, the evaluation of pharmaceutical talents presents multi-dimensional characteristics. Teaching institutions usually use knowledge reserve assessment as the basic basis for judgment, and test students' mastery of core theories such as drug metabolism and pharmacokinetic through written tests. It is worth noting that the evaluation weight of clinical practice is gradually increasing, and the practical scenario evaluation is given by the supervising physician based on the mastery of the operation specifications, especially the key ability of judging drug incompatibility. In this way, industry access certification naturally becomes an important measurement standard, and the acquisition of professional qualifications directly reflects the degree of compliance with the professional benchmark. For example, the completion quality of the prescription review simulation training set up in the teaching process is included in the process observation indicators.

3.2 Analysis of Existing Problems

The current evaluation mechanism still has structural shortcomings that deserve attention. The prominent problem is that the coverage of the ability dimension is uneven, knowledge-based assessments dominate, and soft indicators such as ethical judgments on medication are often ignored. As a result, even if the trainees perform well in drug analysis technology, they may expose the defects of insufficient risk prediction in real diagnosis and treatment scenarios ; another shortcoming is the lack of flexibility in the evaluation methods. Excessive reliance on standardized tests makes it difficult to show personalized development needs. For example, practical abilities such as medication guidance for special populations are often outside the evaluation system. The low level of industry participation in the evaluation also restricts effectiveness. The requirements for handling emergencies in real scenarios of enterprises have not yet been effectively transformed into evaluation factors.

4. THE IMPACT OF INDUSTRY-EDUCATION INTEGRATION ON THE CONSTRUCTION OF THE PHARMACEUTICAL PROFESSIONAL QUALITY EVALUATION SYSTEM

4.1 Providing Multiple Evaluation Subjects

The integration of industry and education has prompted schools, enterprises, industry associations and other parties to participate in the evaluation of pharmacy professional quality. School teachers, with their rich teaching

experience, can effectively evaluate students' mastery of professional knowledge and learning ability. Enterprise mentors can make objective evaluations of students' practical skills, professional attitudes and other aspects based on their performance in internship positions from the perspective of actual work. On the other hand, industry associations have extensive industry resources and professional knowledge, and can provide professional guidance and suggestions for evaluation based on industry standards and development trends. The participation of multiple parties in the evaluation not only enriches the source of evaluation information but also makes the evaluation results more comprehensive and objective.

4.2 Optimizing the Evaluation Index System

Constructing an evaluation framework that adapts to industrial upgrading requires the concerted efforts of multiple parties. After industry experts intervene in the design of assessment standards, the core competency map of the position is naturally embedded in the assessment dimension. For example, the GMP management specifications of biopharmaceutical companies are directly converted into specific assessment points for quality control capabilities. In this way, the ability to handle emergencies in actual combat scenarios can be effectively verified through scenario simulation tests. With the acceleration of the intelligent transformation of pharmaceutical processes, emerging skill indicators such as human-machine collaborative operation of equipment have begun to enter the evaluation system, such as requiring students to complete the fault diagnosis process of the automated filling system. It is worth noting that the establishment of a dynamic adjustment mechanism, regular collection of feedback from the technical departments of pharmaceutical companies, and timely conversion of cutting-edge needs such as the development of new drug delivery systems into evaluation factors, such as the introduction of ethical decision-making analysis of patient medication tracking cases, can comprehensively examine the integration of students' clinical thinking and humanistic care. This dynamic evaluation model of industry-education linkage is reshaping the adaptation accuracy of talent training and industry needs.

4.3 Innovative Evaluation Methods and Means

The current assessment model is undergoing a breakthrough in technological empowerment. Task-oriented assessment sets up real project tasks jointly by schools and enterprises, allowing trainees to demonstrate their problem-solving abilities in developing new preparations or optimizing warehousing processes. The dual-mentor system not only examines the feasibility of technical solutions but also evaluates the efficiency of team collaboration, so that the originally separated theoretical applications and professional accomplishments can be integrated and observed. The introduction of the virtual simulation system has created a new path for immersive assessment. For example, it restores the peak period of drug dispensing in pharmacies, and records trainees' prescription review speed and emergency response strategies through human-computer interaction. For example, by using digital tracking technology, the learning trajectory analysis engine can capture operational blind spots in practical training to form an accurate capability portrait. This dynamic data pool not only records operational results, but also analyzes the rationality of decision-making logic.

5. PRINCIPLES FOR CONSTRUCTING A PHARMACEUTICAL PROFESSIONAL QUALITY EVALUATION SYSTEM UNDER THE BACKGROUND OF INDUSTRY-EDUCATION INTEGRATION

5.1 Scientific Principle

The principle of scientificity requires that the construction of the evaluation system be based on scientific theories and methods. The selection of evaluation indicators should have a clear theoretical basis and be able to accurately reflect the connotation and constituent elements of pharmaceutical professionalism. For example, when selecting indicators for evaluating professional ethics, reference should be made to relevant theories such as ethics and pharmaceutical ethics to ensure the rationality of the indicators. The choice of evaluation methods should also be scientific and reliable. For example, in exam evaluation, standardized questions and scoring methods should be used to ensure the accuracy and fairness of the exam results.

5.2 Principle of Prcticaality

The principle of practicality emphasizes that the evaluation system must conform to the actual situation of pharmaceutical vocational education and have practical application value. Therefore, it requires that the evaluation

indicators and methods should be concise, clear, easy to operate and implement. The evaluation standards formulated in the internship evaluation should be specific and clear. Enterprise mentors can easily evaluate students based on their daily work performance. The evaluation results should be able to provide valuable reference for teaching improvement, student development and enterprise employment.

Dynamic principle

The pharmaceutical industry is a rapidly developing industry with new technologies and new standards constantly emerging. Therefore, the evaluation system should also be dynamic and able to be adjusted and improved in a timely manner as the industry develops. Evaluation indicators should be updated according to changes in the industry. For example, with the development of precision pharmacy, the evaluation indicators can include an examination of students' mastery of genetic testing technology and pharmacogenomics knowledge. Evaluation methods should also keep pace with the times and introduce new evaluation means and technologies in a timely manner.

Principle of comprehensiveness

The principle of comprehensiveness requires that the evaluation system covers all aspects of pharmacy professionalism and avoids one-sided evaluation. It should pay attention to students' professional knowledge and skills, as well as the evaluation of comprehensive qualities such as professional ethics, professional awareness, and communication skills. In the design of evaluation indicators, various factors should be considered comprehensively to ensure the comprehensiveness of the evaluation. Moreover, the process should run through the entire process of students' learning and practice, from classroom learning to internships and training, to comprehensively and dynamically evaluate the development of students' professional qualities.

6. CONSTRUCTION FRAMEWORK OF THE EVALUATION SYSTEM OF PHARMACY PROFESSIONAL QUALITY UNDER THE BACKGROUND OF INDUSTRY-EDUCATION INTEGRATION

6.1 Design of Evaluation Index System

The construction of the professional competence assessment framework needs to be closely linked to the evolutionary logic of industrial needs. The knowledge architecture dimension focuses on the core cognition of the discipline. For example, the understanding of drug metabolism mechanism is broken down into specific observation points, and the knowledge transfer ability is verified through the prescription review simulation system. In this way, the handling process of drug adverse reaction warning can be transformed into a situational assessment module. Introduce a dual-track assessment mechanism at the level of professional ethics, observe the rigor of the implementation of regulations in practical training, and examine the communication of ethical decisions through a simulation drama of doctor-patient conflicts. For example, the team role adaptability in new drug research and development projects is used as a dynamic assessment carrier for collaborative capabilities, and corporate mentors judge the implementation effect of innovative thinking based on this. For the practical dimension, a step-by-step observation node should be set up, from the proficiency of basic equipment operation to the emergency response to sudden production accidents, to form a progressive capability map. The application of digital twin technology makes the decision path in the virtual scene of workshop management traceable, providing three-dimensional data support for the assessment of compound capabilities. This kind of industry-education linkage assessment ecology ensures that talent training always resonates with industrial technology iteration.

6.2 Selection of Evaluation Method

The innovation of evaluation paths needs to break the traditional single dimension. Theoretical tests test the depth of subject cognition, while prescription design sandbox simulation can map the efficiency of knowledge conversion. For example, in a simulated drug recall scenario, the trainee's crisis handling strategy will be quantified and scored by the dual mentor group, which not only examines the application of regulations but also evaluates contingency thinking. Alternatively, the intelligent pharmacy management system can be introduced, and the operation log can automatically generate a skill mastery heat map to accurately locate technical blind spots. The skill competition platform stimulates innovation potential, and the industry-level competition results are converted into an objective yardstick for ability advancement. Corporate mentors set up sudden equipment failure

points on real production lines to observe the quality of the trainees' standard operating procedures. In this way, the originally abstract professional qualities are transformed into quantifiable operation nodes, and digital tracking technology realizes the recording of the entire process, from the frequency of use of laboratory instruments to the analysis of clinical communication techniques, forming a multi-dimensional ability portrait.

6.3 Determination of the Evaluation Subject

The subject framework of competency assessment needs to achieve the integration of multiple perspectives. Subject teachers focus on observing the absorption effect of theoretical knowledge and capture blind spots of thinking through classroom question-and-answer interactions. Corporate mentors track the standardization of technical operations in real production environments, such as recording the GMP execution details of trainees in the aseptic filling process. In this way, the involvement of technical committee members of industry associations is particularly critical. They use the industry's cutting-edge perspective to calibrate the evaluation dimensions. For example, the quality control director of a pharmaceutical company participates in the formulation of the assessment rules for drug sample retention management to ensure that the standards are synchronized with industry norms. In the self-assessment phase, a competency growth file is set up. Trainees regularly review prescription review error cases. This reflection mechanism promotes self-cognition iteration. Peer evaluation focuses on collaborative effectiveness, such as the division of labor and cooperation in drug compatibility experiments. Anonymous feedback from team members can often reveal potential communication barriers. Patient role players can be introduced to participate in service process evaluation to detect the understandability of medication instructions from the user's perspective. This three-dimensional evaluation network significantly improves the accuracy of competency portraits through cross-validation of data from multiple subjects.

7. IMPLEMENTATION GUARANTEE OF THE PHARMACEUTICAL PROFESSIONAL QUALITY EVALUATION SYSTEM UNDER THE BACKGROUND OF INDUSTRY-EDUCATION INTEGRATION

7.1 Strengthening the Depth of School-enterprise Cooperation

Deepening the cooperation between schools and enterprises is an important guarantee for the implementation of the evaluation system. Schools and enterprises should establish long-term and stable cooperative relations, jointly formulate talent training programs and evaluation standards, and jointly build training bases to provide students with a real practical environment so that students can improve their professional qualities in practice. For example, schools can cooperate with pharmaceutical companies to establish a pharmaceutical production training workshop. Students perform production operations in the workshop, and corporate mentors provide on-site guidance and evaluation. Enterprises can also provide part-time teachers for schools to bring the industry's latest technologies and concepts into the classroom. Schools should strengthen the management of corporate internships, communicate with companies regularly, understand students' internship situations, solve problems in a timely manner, and ensure the effectiveness of internship evaluations.

7.2 Improving Teachers’ Evaluation Capabilities

Teachers play a key role in the implementation of the evaluation system. Therefore, to improve teachers' evaluation capabilities, schools should organize teachers to participate in relevant training, learn advanced evaluation concepts and methods, understand industry development trends, improve the professionalism of evaluation, and encourage teachers to go deep into corporate practice and familiarize themselves with the actual work processes and requirements of the pharmaceutical industry, so as to better integrate industry standards into the evaluation. For example, teachers can practice in hospital pharmacies to understand the actual operations of drug preparation and management, so that they can more accurately grasp the requirements of practical skills when evaluating students. It is also possible to establish a teacher evaluation ability assessment mechanism to encourage teachers to continuously improve their evaluation level.

7.3 Improve the Evaluation and Feedback Mechanism

Establish a sound evaluation feedback mechanism to ensure that the evaluation results can be effectively used. After the evaluation is completed, the evaluation results should be promptly fed back to students so that they can understand their strengths and weaknesses and develop improvement plans. The evaluation results should also be

fed back to teachers, who will adjust the teaching content and methods based on the feedback to improve the teaching quality. Enterprises should also provide schools with suggestions for talent training based on the evaluation results to promote the coordinated development of schools and enterprises.

8. CONCLUSION

In summary, building a pharmaceutical professional quality evaluation system under the background of industry-education integration is a key measure to improve the quality of pharmaceutical vocational education. Only by deeply understanding the connotation of industry-education integration and pharmaceutical professional quality and analyzing the problems of the existing evaluation system can we follow the scientific and reasonable construction principles, build a complete evaluation system framework, and provide strong implementation guarantees, so as to cultivate more high-quality pharmaceutical talents that meet the needs of the pharmaceutical industry. In the future, we should further strengthen the research and practical exploration of the evaluation system, continuously optimize the evaluation indicators, innovate the evaluation methods, improve the scientificity and effectiveness of the evaluation, and provide solid support for the high-quality development of pharmaceutical vocational education.

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